June 15, 2004

Testimony before the Governor's Task Force on Energy Efficiency & Renewables

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Good Morning. I want to thank you for your work. It is vitally important to the health and economic vitality of our state economy.

I am here today as a citizen of this state, a representative of those many who could not make it, and as a founder and/or senior partner in a number of small, young enterprises that have one common goal: taking the best work that a few are doing in environmentally responsible practices in our economy and helping more do them.

The headline on my message to you is simple: Speed ahead, be clear and convincing and be bold in your actions. Time and opportunity are wasting.

I give you this perspective to help put my comments in a context: When I was born 54 years ago there were nearly 2.7 billion humans seeking safety and health on planet earth. Today – half a century later and in very much less than a blink in the age of our planet – there are 6.3 billion and counting, many of them striving hard to become good consumers in the Madison Avenue way (witness China today and its effect on our gas and steel prices).

I am sure the committee members know that the impact of this generation – led by the mighty Baby Boomers -- has been profound in a score of ways, some of which we are only just starting to comprehend today. Amid the fervor for an ever-increasing GNP -- or a GWP for Gross World Product – we are hitting the walls of our very finite planet earth. We are running out of fossil fuels, and not a moment too soon since the planet as we have known it can't absorb the impact any more.

I am glad to see that this task force has linked Energy Efficiency <u>and</u> Renewables in its title, for – to paraphrase Aldo Leopold a bit – you can't have an intelligent energy production without an intelligent consumption policy. As such, the job of this Task Force is complex and far reaching because you can touch virtually every part of our economy and society if we are to begin the kind of shift that is needed.

Our biggest, most cost effective gains today – saving both money and quickly reducing impact on the environment – come through increased energy efficiency in what we are already doing. Fortunately, these gains are simple, the low hanging fruit, because – frankly – we know what to do. The key issue is getting more to do it. So, please, before your deliberations are complete, make certain you address a few key driving forces of behavior:

- Does Wisconsin have a clear, bold goal? What is Wisconsin really trying to achieve? Is it 20% renewable energy by 2010? Is that all? Will our children be out of the woods if we hit that mark? What about goals of energy consumption in terms of products produced in the state or per worker? What about "green" job creation, or advancement of an economic sector – call it maybe environmental leadership – that can serve as focus for industry growth in Wisconsin and an export for the world.

- Is there clear, simple, regular reporting of a few leading energy indicators – and pictures are better than words – of the measures of improvement that the average person can see and quickly understand? In our work, we have found that such simple awareness – such as a run chart over time of energy use and the associated costs – can go a very long way in starting to change behavior.

- Does the price we pay for energy reflect the full cost of that energy to our citizens and to our environment? Does the consumer know when he or she pulls out the charge card that the costs of coal-produced electricity cover the cost of mercury in the lakes, asthma in our children, ozone in our cities, or the investment subsidies that brings that coal to Wisconsin? Does the price of nuclear energy today reflect the cost of the safe storage of its waste forever? Does the price of gasoline reflect the costs of war? If the consumer has full information in the price he or she pays, then we can better make intelligent decisions about what we consume.

- Will Wisconsin regularly look around the world to make certain we are learning from and adopting to our own unique circumstances some of the best energy generation and management methods and processes? This is a constantly evolving process of learning and modifying, and not just the work of one task force. One of the outcomes of your work must be to set a process in place to be able to well exceed what appear to be now just adjustment of the minimal standards in our codes and requirements.

In summary, I want to communicate a sense of urgency for your work – or our work – or more accurately for your leadership on behalf of our children. Be bold, be clear, and help position Wisconsin as a true leader throughout the 21st century. There is much to gain, and a lot to lose if we are not successful.

Governor Jim Doyle
Governor's Task Force on Renewable Energy
State Capitol, PO Box 7863
Madison, WI 53707

May 28, 2004

Dear Governor Doyle and Governor's Task Force on Renewable Energy:

The main point of this input to your June 15, 2004 public meeting is: renewable energy R&D in Wisconsin should be funded. The price of natural gas is highly volatile, and there is probability that compressed natural gas cartels will be similar to the oil OPEC cartels. The transmission expansion required for large remote power plants like big wind can be compared to the on-site demand-side collection and storage of energy options (PV, wind, etc). Renewable energy R&D should be supported in an ongoing, comprehensive, integrated, and site specific way. Suggested projects and activities are:

Zero net energy (ZNE) district R&D project:
An urban district with houses and apartments can have solar thermal collectors, heat storage, PV, wind generators, earth exchange, and one commercially priced natural gas meter, within an electric vehicle travel range. The ZNE district can have a bio-fuel station supplied from urban waste and farm fuel production facilities for long distance hybrid vehicles. An energy study is proposed that compares ZNE individual houses and individual apartment buildings with comparable ZNE districts with houses and apartments, to include educational, commercial, and industrial facilities, as well as sustainable building materials. New concepts such as the building integrated walk-in CPC flat plate (ref: attached article) and building integrated wind turbines can be evaluated. A ZNE rural district R&D project could include bio-fuels purchased from local farm fuel producers. This could strengthen the local economy and be a more stable fuel operating expense for the long term. One demonstrated example is contained in the enclosed IEA brochure No.151 that may be interesting for the smaller Wisconsin towns with locally appropriate bio-fuels.

PV material R&D and PV manufacturing R&D at The U. of Wisconsin:
There are 1000s upon 1000s of existing roof structures in Wisconsin ready for PV installations. Why are PVs not being installed on these existing roof structures? One reason is there is not a committed organizing entity to coordinate the PV installation, maintenance, metering, billing, etc. like what SMUD is doing in Sacramento. Another reason is the cost of PV. The more significant PV cost reductions may be realized from new PV material R&D and PV manufacturing R&D, and these types of R&D should be started at the U. of Wisconsin to prepare for Wisconsin's future and to participate in the large and growing global PV market.

If there would be interest to discuss these matters please contact me.

Sincerely,

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Prepared for World Renewable Energy Congress VIII, Denver, Aug 28-Sept 3, 2004 ©

ACTIVE SOLAR ENERGY ARCHITECTONIC STRUCTURES

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ABSTRACT

Building integrated (BI) active solar energy schematic structure studies selected from a developing outline include: *Building size augmentation and CPC reflector troughs* (with movable reflector end wall options) symmetric for equatorial zone and asymmetric for higher latitudes, supported on earthen vaults, ferrocement channels, and concrete double Ts; *Interior concentrators* (stationary and tracking) in walk-in double envelopes with flat and ridged exterior glazing, for windy snow sites with heat pipe evacuated tubes and CPC reflectors, and 1-axis tracking parabolic troughs; and *PV pergolas-PVOLTs* (PV Overhead Linkage Trackers). Dimension ranges of active collectors and architectural schematic building structure-envelopes are correlated, e.g. a vault span for equatorial sites of 15m/49.2ft can have a CPC inlet of 17m/55.7ft. Design development is reported for a PV pergola (4 row wood PVOLT-16 PV modules) 1 horizontal axis tracking, with comparisons for solar radiation to 2-axis tracking az-el masts with 18 PV modules, for peak site power density and land use with same 0.92m^2 PV modules, e.g. given a 30.47m/100ft square site in Madison, WI: Nine 2-axis tracking PV arrays have 1237 kWhrs/June day, and eleven PVOLT PV pergolas have 1311 kWhrs/June day plus area for a building. Aims are to present architectural structure and site potentials with integral active collectors, and provide schematic dimension ranges for architectural, engineering and solar cities studies.

INTRODUCTION

Buildings and urban infrastructure with integral renewable active and passive on-site energy design can have different structural form than designs based on energy and fuels imported to the site. Building integrated (BI) active solar and wind collectors and storages can significantly influence building structure form, and if not part of first construction costs, they would have to be designed in at the outset in most cases, for economical future installation. Aims are: rational aesthetic expression of BI active solar technologies, consideration of materials and construction process energy, and to provide schematic dimension ranges for building structure types and site latitudes, as reference for optical and thermal engineering studies. A developing outline (1) supplement illustrates BI studies with individual and combinations of active solar technologies **(Fig. 1)**. BI studies emphasize: stationary augmentation (booster) and building size CPC reflector troughs for increasing temperatures of high performance collectors; interior concentrators (stationary CPC reflectors and heat pipe evac. tubes, and tracking parabolic troughs); and PV pergola wood PVOLTs. Walk-in double envelopes with safe access to interior solar concentrators with no wind and snow loads can focus wind for BI wind turbines **(Fig. 1k)**. Mass produced parabolic trough components may be cost-effective for BI interior applications. Long E-W reflector roofs and large thermal storages could influence urban design. The approach is: integral active solar collectors and storages as a basis for architectural structure and urban design.

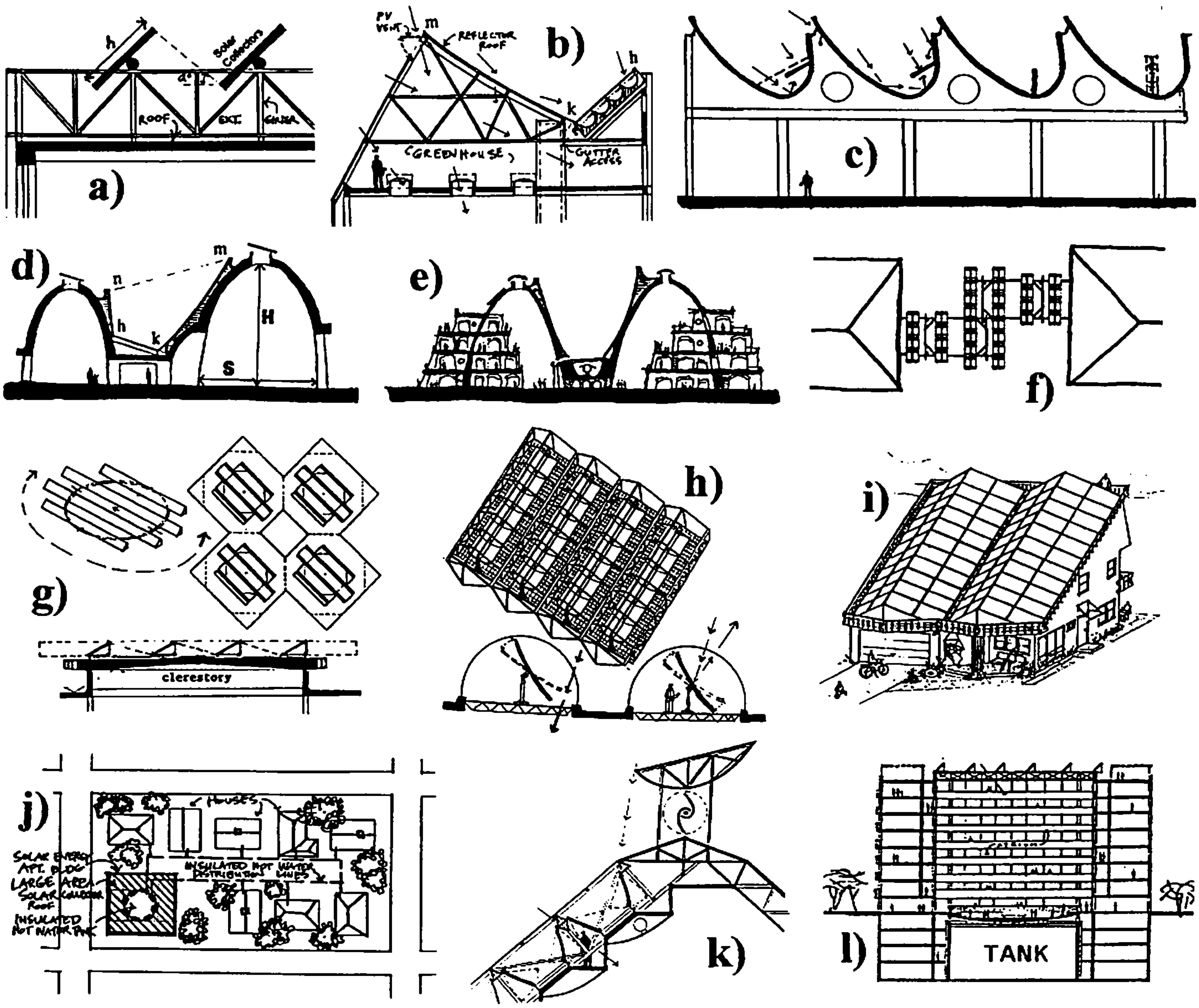


***Fig. 1- Active Solar Energy Architectonic Structures Outline Supplement: a)** flat-plate collectors on exterior structure; **b)** augmentation reflector E-W greenhouse roof; **c)** reflector tiled E-W concrete roof troughs with bifacial collectors; **d)** section of asymmetric reflector CPC trough on earthen vaults; **e)** CPC reflector trough housing; **f)** plan of PVOLT pv pergola; **g)** cluster plan of azimuth tracking collectors above daylight clearstories; **h)** BI interior concentrators (1-axis tracking parabolic troughs and 2-axis trackers in plastic domes); **i)** ridged interior concentrators test facility; **j)** collectors on apartments with large storage for mini-district heating; **k)** walk-in CPC 'flat-plate', wind turbine and PV air foil; **l)** storage tank below atrium.*

BI REFLECTOR AUGMENTATION and CPC TROUGHS

BI east-west building size stationary reflector augmentation (booster), asymmetric and symmetric CPC troughs, with adjustable reflector end wall options (1), for no snow accumulation sites, can be structured in various ways with construction tolerances compatible with nonimaging optics. Slightly curved parabolic roof/wall rain catchments faced with standard sized flat glass-silver reflectors can passively concentrate radiation to increase temperatures of high performance collectors **(Fig. 2)**. Adjustable end wall reflectors can: reduce spillage, block disturbing reflections, and form dynamic shaded places. Small reflector end walls may be with banner substrates. Reflector end wall optical and thermal performance are now being investigated (7). Site latitude approximations are: equator to 15 deg. lat. for equal side CPCs; 20 deg. lat. for asymmetric CPCs; and 35 deg. lat. for augmentation (1-side 'CPC'). A small reflector side of asymmetric CPCs tends to overhang at more than 20 deg. lat. sites and can be a limit to avoid overhanging reflectors **(Fig 2e)**.

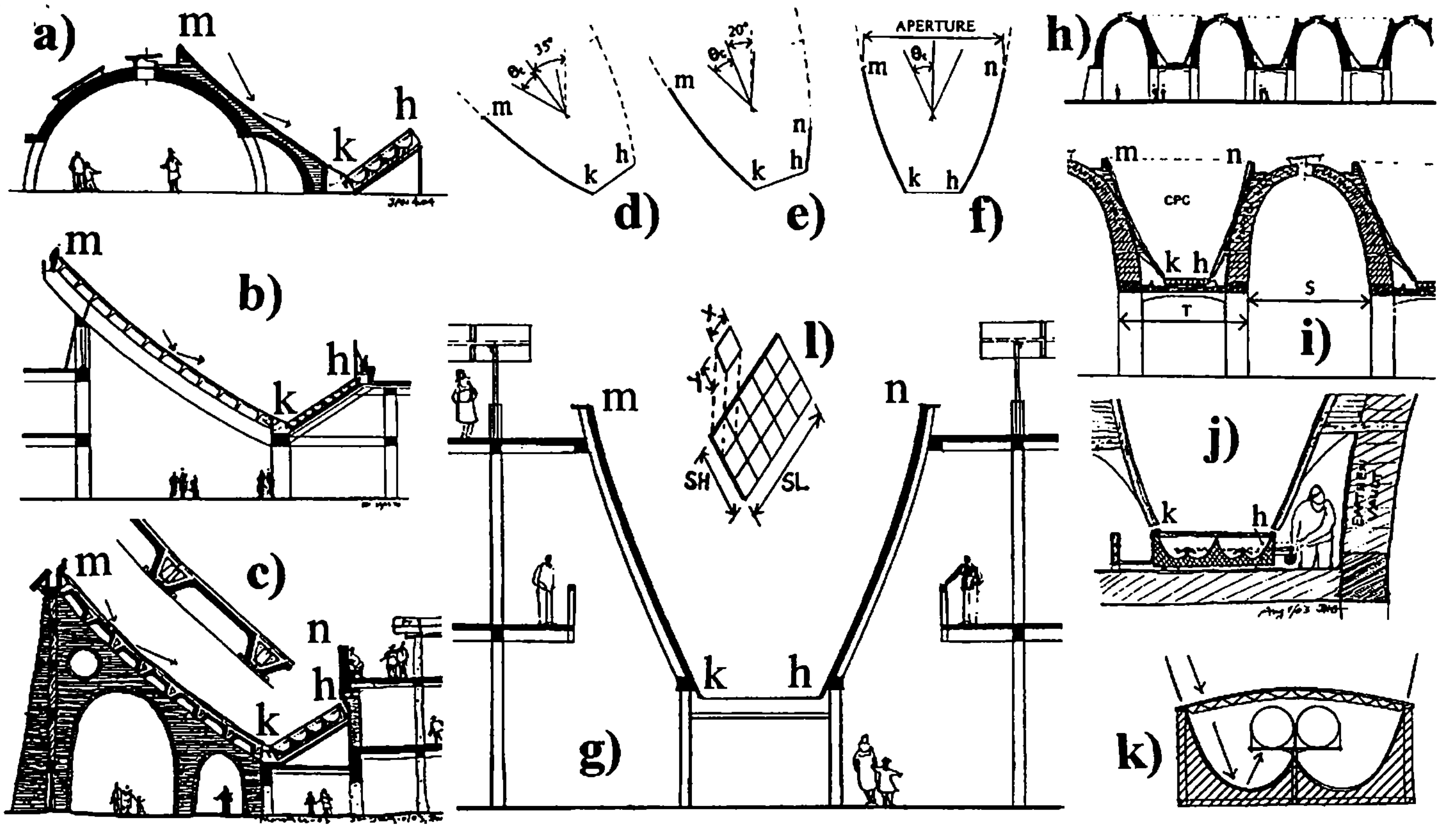
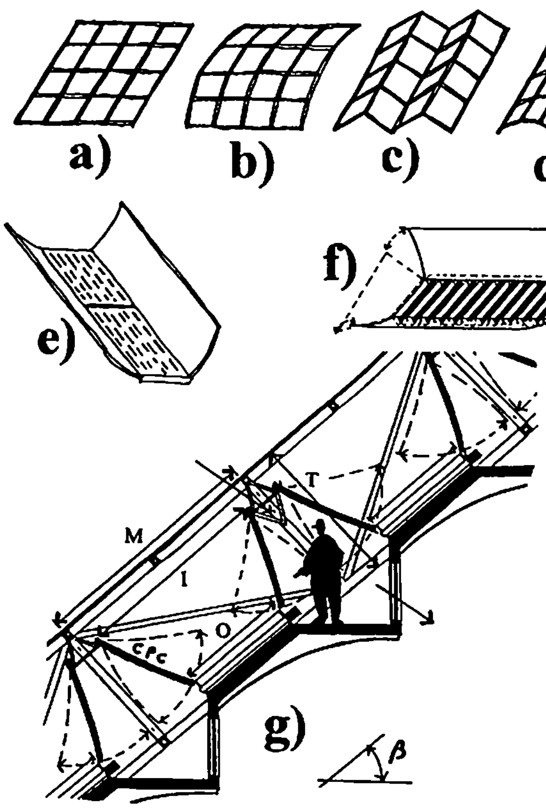


*Fig. 2- BI E-W Reflector Augmentation and CPC Troughs: **a)** cylindrical vault section; **b)** concrete beams with precast double tees; **c)** masonry walls with ferrocement channel lost moulds; Diagrams and site latitudes- **d)** 1-sided 'CPC' at 35 deg, **e)** asymmetric CPC at 20 deg, **f)** CPC at equatorial zone; **g)** BI CPC section with vertical ferrocement channels; **h,i,j)** sections of CPCs with earthen vaults; **k)** air 'U tube absorber with involute reflector and cover glass; **l)** standard flat glass mirror panel.*

BI reflector augmentation and CPC trough dimensions in Table 1 have truncation ratio mk/kh = 2.83; and m-k per structural construction type can be: 8m/26.2ft for prefabricated ferrocement elements (6) **(Fig. 2g)**; 10m/32.8ft for E-W ferrocement channel lost moulds and insitu concrete E-W beams on N-S masonry walls **(Fig. 2c)**; 17m/55.7ft for stabilized earthen vaults (5)**(Fig. 1d,2a,2i)**; 20m/65.6ft for reinforced concrete N-S beams with E-W precast double Ts rolled up **(Fig. 2b)**, N-S wood glulam beams, or N-S open web steel girders; 50m/164ft for suspended concrete (precast slabs hung on cables with insitu ribs) or reflector panels attached to suspended cable nets; and 2-5m/6.5-16ft for a reflective tent side adjacent to solar box cookers. Larger vaults with seismic resistance can be reinforced sprayed concrete on inflatable forms, and concrete thin shell vaults can span over 100m/328ft. Long span semi-shaded E-W open air terraces with reflector panels attached to cable net structures may be similar in form to the selected US DOE solar wall design (10). A demonstration building of BI reflector augmentation was with a wood truss-folded plate 'saw tooth' roof structure (8). Large CPCs with proportionately large absorbers may have U tube air systems **(Fig. 2k)**; and inclined heat pipe evacuated tube collector rows- inverted V(^) with 2 rows and dual condenser inlets to a pumped fluid manifold for the equator zone, and overlapping rows for asymmetric CPCs at higher latitudes.

TABLE 1: DIMENSIONS FOR BI AUGMENTATION AND CPC SCHEMATICS

Figure	m-k	k-h	m-n	vault span S	T
Fig 2i	3.4m/11.15ft	1.2m/3.93ft	3.4m/11.15ft	3m/9.84ft	3.2m/10.49ft
Fig 2i	5.66m/18.57ft	2m/6.56ft	5.66m/18.57ft	5m/16.40ft	5.33m/17.48ft
Fig 2i	11.33m/37.17ft	4m/13.12ft	11.33m/37.17ft	10m/32.81ft	10.66m/34.99ft
Fig 2i	17m/55.77ft	6m/19.68ft	17m/55.77ft	15m/49.21ft	16m/52.49ft
Fig 2g	8.0m/26.24ft	2.82m/9.27ft	8.0m/26.24ft	~	~
Fig 2g	11.33m/37.17ft	4m/13.12ft	11.33m/37.17ft	~	~
Fig 2g	17m/55.77ft	6m/19.68ft	17m/55.77ft	~	~



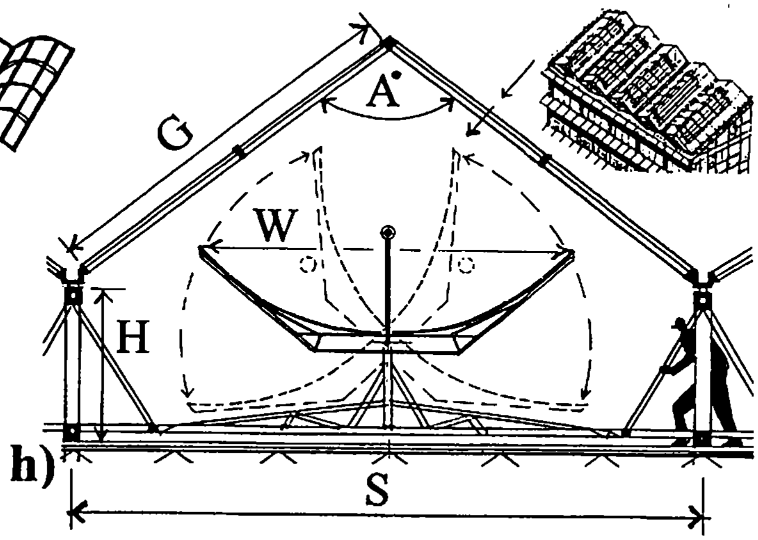


TABLE 2: TRACKING PARABOLIC TROUGHS + RIDGED GLAZING

W	S	G	H
15.44ft/4.7m	26.24ft/8m	14.63ft/4.76m	6.13ft/1.86m
19.25ft/5.87m	32.80ft/10m	19.52ft/5.95m	7.61ft/2.32m
23.13ft/7.05m	39.37ft/12m	23.4ft/7.14m	9.85ft/3.0m
26.96ft/8.22m	45.93ft/14m	27.33ft/8.33m	10.66ft/3.25m
30.84ft/9.4m	52.49ft/16m	31.23ft/9.52m	12.2ft/3.72m

***Fig. 3- BI Double Envelope with Interior Concentrators:** Exterior glazing options **a)** flat, **b)** curved, **c)** ridged, **d)** vaulted; Stationary interior concentrators **e)** N-S inclined CPC reflectors onto flat plate; **f)** E-W CPC reflectors onto N-S inclined heat pipe evacuated tubes above involute reflectors; **g)** Section of walk-in 'flat-plate' with stationary E-W CPCs onto N-S inclined heat pipe evacuated tubes and involute reflectors with day lighting; **h)** Section of ridged double envelope module with interior 1-axis tracking parabolic trough.*

BI INTERIOR CONCENTRATORS

BI interior concentrators (stationary and tracking thermal collectors) with no snow and wind loads in walk-in double envelope air heater roof/walls with day lighting, have exterior glazing options that include: flat, curved, ridged, and vaulted **(Fig. 3a-d)**. Stationary interior concentrators include: N-S inclined CPC reflectors onto high performance collectors **(Fig. 3e)**; and E-W CPC reflectors onto N-S inclined heat pipe evacuated tubes (hp-et) above involute reflectors, with moveable end wall reflector options **(Fig. 3f)**. Tracking options include: 1-axis tracking N-S inclined CPC reflector troughs (1); heliostats-Schefflers(1); and 1-axis tracking N-S inclined parabolic troughs for beam sites **(Fig. 3h)**. Thermal collectors can accommodate shade lines and mullion-structure can have reflective sides for enhanced collection and night lighting effect.

Schematic dimensions for a BI stationary concentrator inclined at 40 deg. from horizontal for windy snow sites with E-W CPCs and N-S hp-et are: outlet of CPC trough O = 2.11m/6.92ft (length of hp-et and involute reflector); 2-way structural open web girder depth T = 2.9m/9.5ft (limited for transport of prefabricated steel structure); CPC inlet aperture I = 3.69m/12.11ft (CPC reflector panels are hinged for maintenance access); and M= 4.39m/14.42ft (exterior building glazing-mullion structure spacing)**(Fig. 3g)**.

An inclined ridge exterior glazing with interior tracking parabolic troughs **(Fig 3h)** has a similar schematic architectural framework reported for tracking nonimaging troughs with hp-et (1). Interior parabolic trough reflector options include: back silvered glass, and tensed reflector tapes. Dimensional relationships for a ridged exterior glazing building module with angle A = 110 deg. are in Table 2: parabolic trough aperture (W), ridged glazing side (G), building structural module width (S), and N-S inclined open web girder height (H)**(Fig 3h)**. A testing verification facility can be a modest building **(Fig.1i)**.

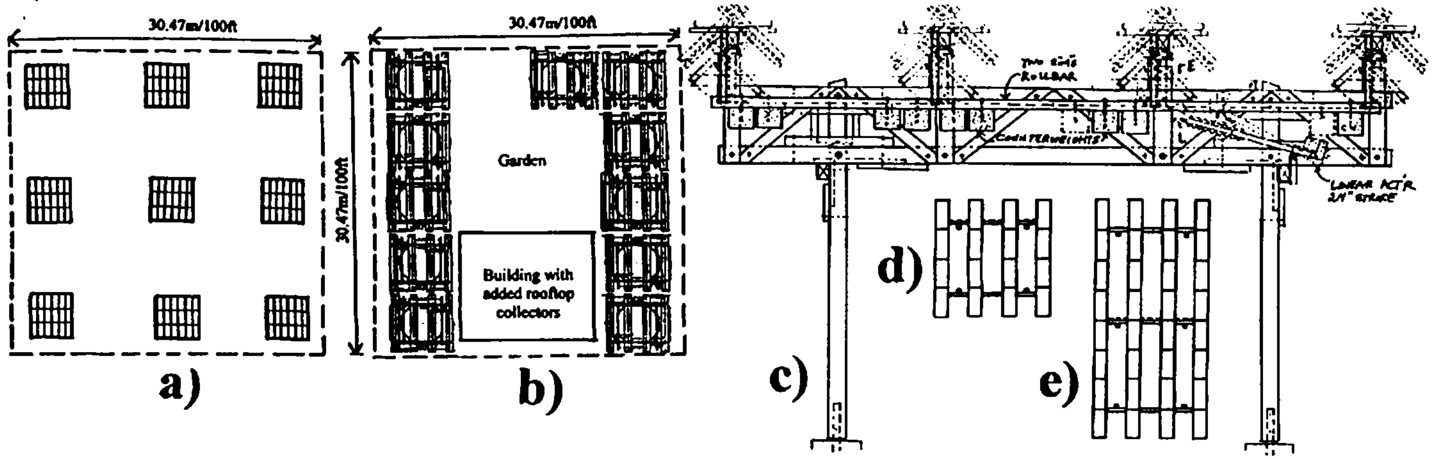


*Fig. 4- PV Pergolas (PVOLT): Comparative plans- **a)** 9 two-axis az-el trackers-162 PVs, **b)** 11 four row PVOLTs-176 PVs; **c)** North elevation of 4 row wood PVOLT (16 PVs); **d & e)** plans of 4 row PVOLTs*

PVOLT (PV Overhead Linkage Tracker) PV PERGOLA

PVOLTs 1-horizontal axis tracking with: 0.6m/24" travel actuator; sun sensor controller, S. Pine treated lumber for do-it-yourself construction at urban/suburban sites have a typical row of 4 (1.42m x 0.65m) PVs on a 9cm/3.5"x14cm/5.5" wood beam. A 2 row Wood PVOLT without counterweights (CWs) tracked in Wisconsin for 9 months with no reported maintenance costs/problems. A new linkage roll bar design has two separated wood 4cm/1.5"x9cm/3.5" parts with hung CWs. After wood beam bending stress analysis (3), deflection/creep analysis by R. Moody PE for 1/240 of 3.68m/145" span resulted in roll bar CWs/row to 91kg/200 lbs reduce mid-span deflections (4). A 4 row (16PVs) Wood PVOLT is counterbalanced with 11 concrete ½ block 200mm/8"cubes with cast-in bolts (14.5kg/32 lbs each). PVOLTs (4 row/16 PVs) with overhead wiring, and 2-axis (az-el) mast trackers (18 PVs) with trench wiring are compared with 0.92m² PVs for summer peak solar radiation. Given a 30.47m/100ft square site in Madison, WI: Nine 2-axis (az-el) trackers (162 PVs) have 1237 kWhrs/June day, and eleven PVOLTs (176 PVs) have 1311 kWhrs/June day plus expensive urban land for a building, etc.**(Fig. 4a&b)**. A longer 2-span row supported at 3 bearings with equal overhangs (steel spliced wood beams or square tube steel or reinforced plastic) with inter-row linkage at the center roll bar can reduce columns, trusses, roll bars, bearings, etc. per PV unit area **(Fig 4e)**. Fabricated steel 64 part sets sized for parcel shipping for a 4 row Wood PVOLT cost estimates USD$ for 1, 5, and 25 sets (without foundation plates) were: mild steel powder coated ($540, $372, $324 each); mild steel galvanized ($470, $438, $388 each), and stainless steel ($553, $414, $362 each) not including transport, parts clean up, and packaging/shipping. Well vented PVOLTs can be: adjacent to buildings at the E&W to reduce summer heat gain, in gardens, and on roof terraces up near tall trees; and tracking may deter perching/nesting.

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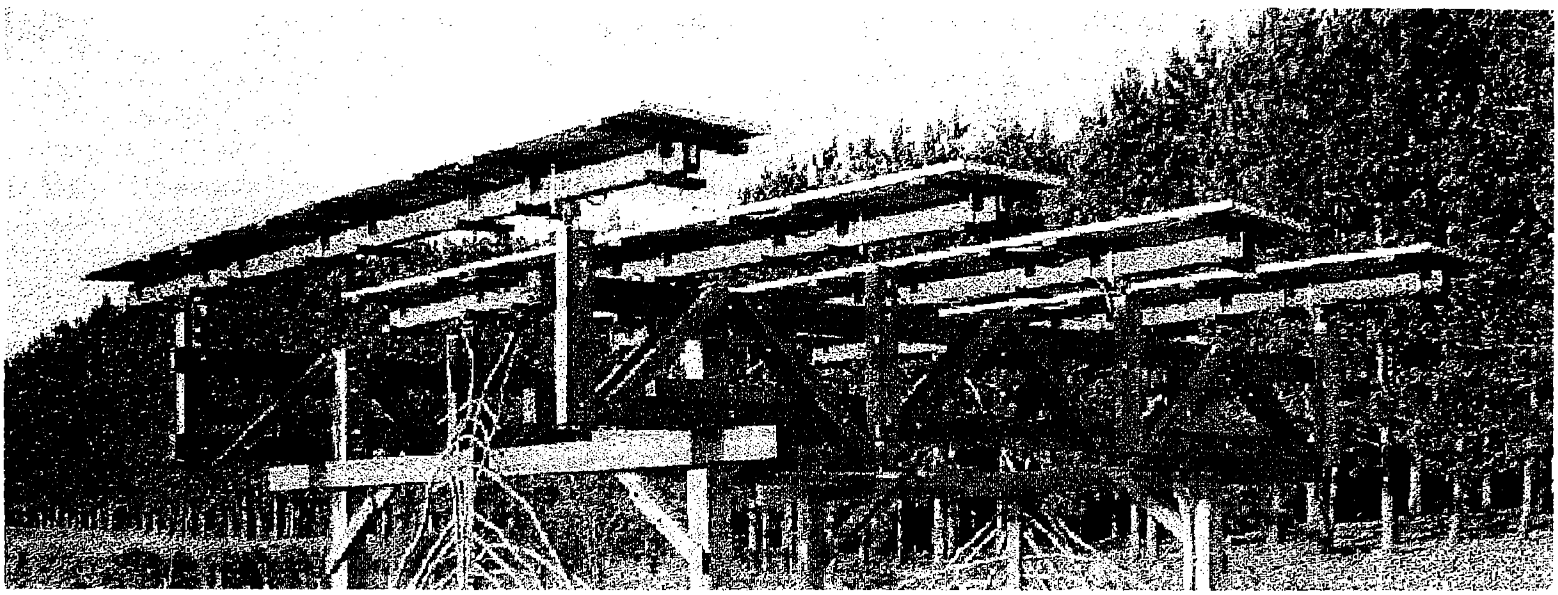


CADDET IEA OECD

renewable energy

Straw-based "Neighbour Heating" in Denmark

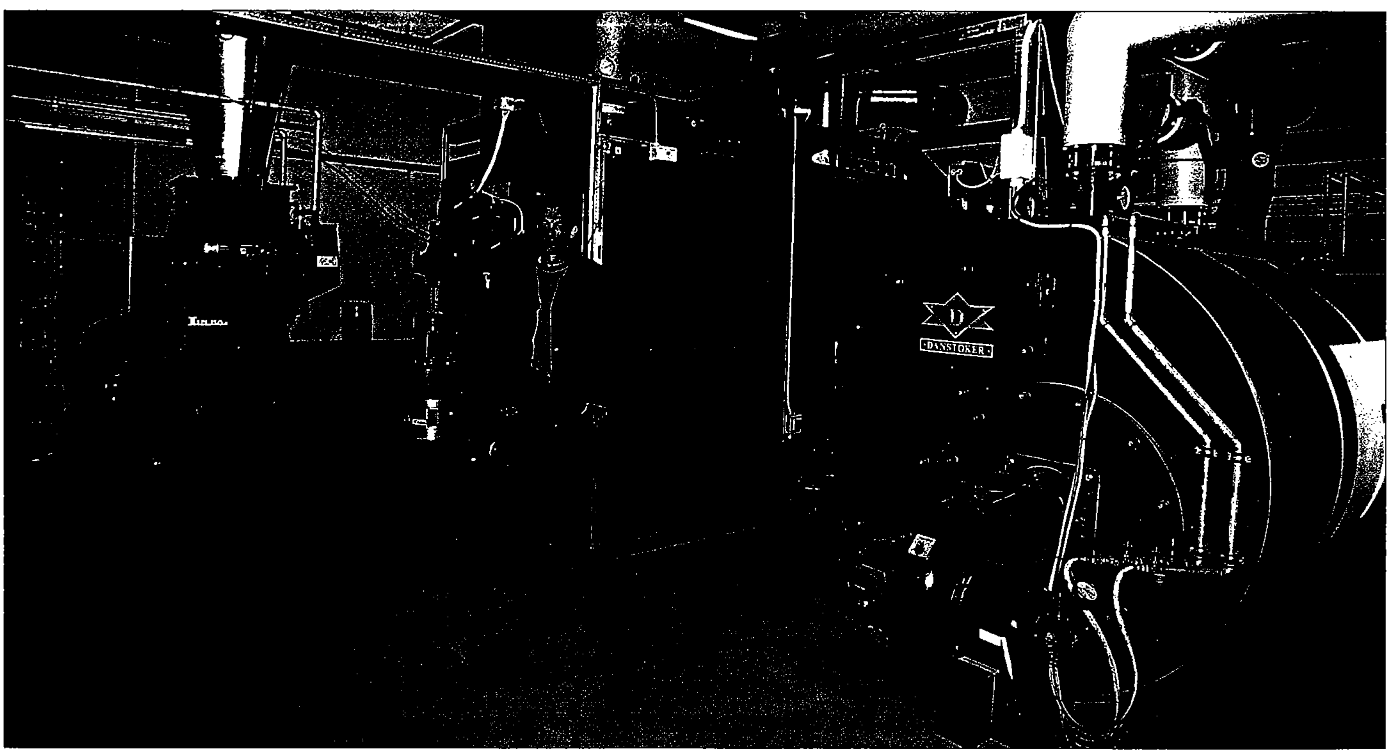
Summary

In recent years, some Danish farmers have invested in extra-large straw-fired boilers to supply heat to one or more neighbours and thus use their own straw production. This is particularly applicable to rural areas, where the installation of conventional district heating plants is too expensive.

In the village of Sdr Nissum, in Jutland, a straw-fired neighbour heating plant was installed during August 1999 at half the price of a conventional district heating plant. The system consists of a biomass-fired central heating boiler and a district heating network that distributes heat to 70 households and local municipal facilities. Because of the simple operation and straightforward organisational set-up, the administrative costs are kept to a minimum. The project is supported by the Danish Energy Agency.

- **Established at half the price of a conventional district heating plant**
- **On-farm straw-firing is an indigenous and CO_2 neutral option for local heat supply**
- **Sustainable energy supply for a small town**

Straw-fired heating plant.



Photograph: BioPress

Project Background

Denmark has a very varied energy supply system which, after the oil crisis in the 1970s, switched successfully from oil to coal and, during the 1980s and 1990s, moved gradually towards an increased use of renewable energy. Combined heat and power (CHP) production, as opposed to separate generation of heat and electricity, has played an important role in Danish energy policy. Today, more than 50% of the Danish requirement for heating is met by district heating (DH). About 70% of this DH is produced by CHP plants.

Some smaller DH plants produce district heat only and for this type of facility the trend is towards building ever-smaller biomass-fuelled plants. On average, new DH plants from the 1990s are only half the size of plants from the 1980s. However, in Denmark, the market for DH plants is nearly saturated and at the moment neighbour heating is increasing in areas where conventional DH is too costly. In these rural areas, some farmers invest in larger straw-fired boilers than they need for their own heat supply and sell the surplus heat to their neighbours. In some cases, this can reduce the cost of a heating plant by 50% compared with a traditional DH plant. Such plants are typically owned by the farmer or perhaps established as a partnership.

The Project

Some years ago, the local authorities in Sdr Nissum tried to implement a district heating project costing about DKK 10 million (where DKK is the Danish krone). This was too large an investment for a community of only 130 households and the entire project was abandoned. However, today the local primary school, sport centre, rest home for elderly people and 70 of the households are supplied with heat from a straw-fired neighbour heating plant owned by one of the town's farmers. In the mid-1990s he sold his cattle and focused entirely on crop production. With 430 hectares, he has a considerable amount of straw which is burned in the neighbour heating plant. The need for straw will probably increase in the future as several electrically heated households in Sdr Nissum have shown interest in being connected to the straw-fired heating system.

Originally, the farmer did not plan to supply heat for private households, but news spread about an agreement with the local authorities and he was approached by a number of private individuals who were interested in participating in the project. Within a few weeks, 56 households had signed up and today the number is 70. He currently produces DH equivalent to the consumption of 105 households.

The differences between an actual DH plant and a neighbour heating plant larger than 250 kW are mainly

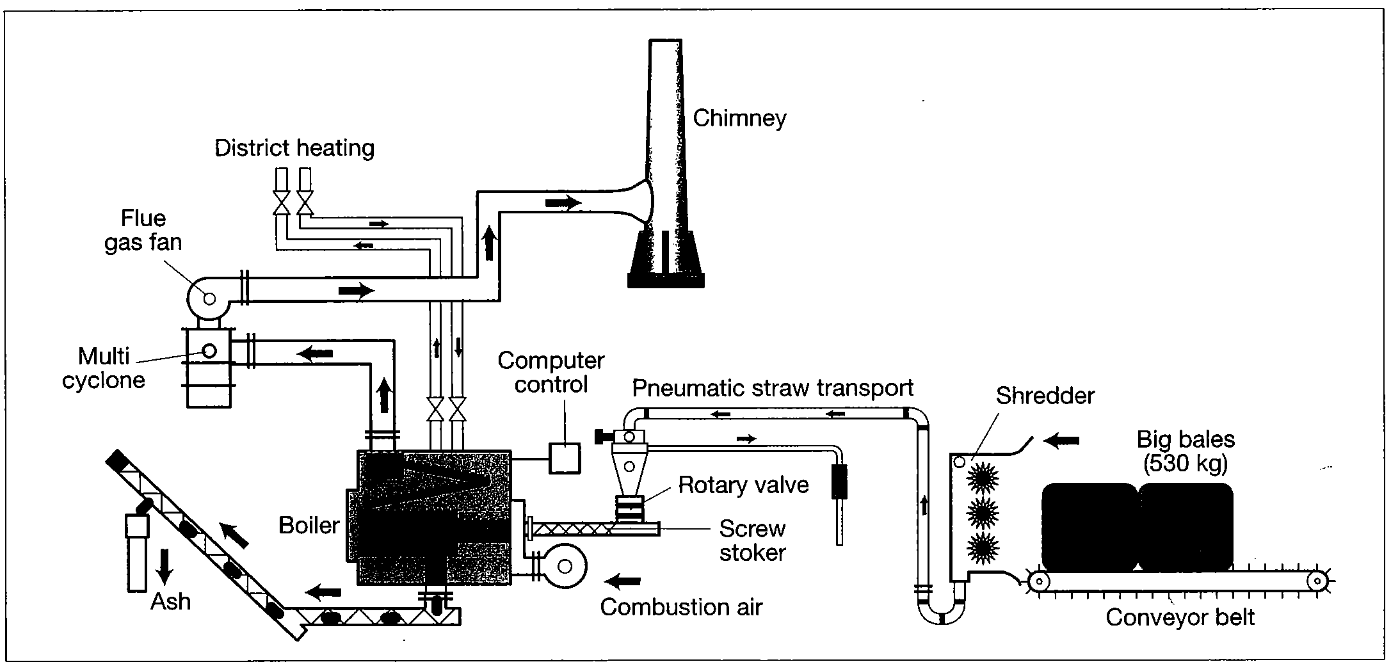


Figure 1: Diagram of the straw-fired neighbour heating plant.

Table 1: Typical initial costs of a straw-fired neighbour heating plant				
	Plant size			
	100 kW	200 kW	400 kW	800 kW
Cost of boiler plant	DKK 200,000	DKK 300,000	DKK 400,000	DKK 900,000
Cost of boilerhouse	DKK 70,000	DKK 70,000	DKK 90,000	DKK 120,000
Cost of straw storage facilities	DKK 1,000–1,100/m²			
Cost of main pipeline	DKK 1,000–1,200/m			
Cost of service pipe	DKK 10,000–15,000/consumer			
Cost of household installation	DKK 10,000–15,000/consumer			

size and type of ownership. A DH plant is typically larger than 1 MW and organised in the form of a private limited liability company (Amba) or is publicly owned, eg by the local authorities. Neighbour heating plants are typically owned by farmers or established as a partnership with only one or two partners.

Performance

The 800 kW straw-fired boiler, designed to supply 70–80% of the heat required for the coldest winter period, was manufactured by LIN-KA ENERGY A/S. The size ensures optimum heating economy in the winter as well as in the summer when the heat production required is for domestic hot water only. During the coldest part of the winter, the system is supplemented by an oil-fired boiler, which also supplies heat when the straw-fired boiler is off-line for maintenance. From October 1999 to October 2000, the consumption of straw totalled about 900 big bales each of 530 kg and the oil consumption amounted to about 1,500 litres. The heat production in the same period was about 2 GWh.

The farmer spends 30–60 minutes/day operating the plant. Most of this time is spent moving straw bales onto a conveyor. The bales are automatically transported to a shredder and then into the boiler.

Economics

Total investment costs were DKK 5.5 million (1998 prices). The cost of the straw-fired heating plant, pipework and straw storage barn amounted to DKK 4.7 million. The total cost of the individual consumers' heating installations was DKK 800,000. The Danish Energy Agency provided a grant of about DKK 1.3 million and the remainder was financed through a 10-year loan from a local bank. Each consumer made a token payment of DKK 600 to be connected to the heating plant and signed identical agreements for a 10-year period, which is the same as the depreciation period. The consumers paid for the removal of old boilers and indoor installation of DH connections.

The cost of the DH was calculated to offer the private consumers typical savings of DKK 1,000–2,000/year by replacing oil-based heating with straw-based heating. The price is linked to an oil price of DKK 4.20/litre with a maximum fluctuation of 10% either side. In 1999, the price per MWh of DH was about DKK 485 (including VAT). From the beginning, a special heating price was agreed with the local authorities.

Investment costs were almost half those of the abandoned DH project. According to the farmer, there are several reasons why the project has become so profitable:

- the main contractor, LIN-KA ENERGY, had reasonable charges;
- no expenses were paid for consulting and building inspection;
- the facilities are relatively modest, as they consist only of a straw storage barn and an integrated central boiler station;
- as there are no employees, there is no need for toilets, shower facilities, canteen or office;
- the whole business is run from the farmhouse and his wife keeps the accounts.

Photograph: BioPress

The boilerhouse.

Environment

As well as being economically profitable, straw-fired neighbour heating is environmentally attractive. As an indigenous and CO_2 neutral fuel, straw is a significantly cleaner energy source than fossil fuels.

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International Energy Agency

The International Energy Agency (IEA) is an autonomous body which was established in 1974 within the framework of the Organisation for Economic Co-operation and Development (OECD) to implement an international energy programme.

Printed on environmentally friendly paper.

CADDET

CADDET was set up in 1988 as an IEA Centre for the Analysis and Dissemination of Demonstrated Energy Technologies. Today, there are two CADDET operations: one is for energy-efficient technologies and the other for renewable energy technologies. The Centres co-operate with member countries in the exchange of high quality information on energy technologies.

See the whole range of CADDET Renewable Energy projects on www.caddet-re.org

DK 01 504 First printed: March 2001

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Testimony of Jennifer Giegerich, WISPIRG State Director to the Governor's Energy Task Force, June 15, 2004

I would like to thank members of Governor Doyle's Energy Task Force for allowing me to address you this morning and for allowing members of the public to comment as well. This is an exciting moment in Wisconsin; energy policy is critical to any other effort we undertake as a state, whether it is to grow our economy, enhance our quality of life, and protect and preserve our natural environment. However, if Wisconsin is going to seize the opportunity of renewable energy for our state, we need public policy that not only supports new generation, but that also ensures that we are generating energy from truly clean and sustainable sources and at levels that make future renewable energy economically advantageous relative to heavily subsidized fossil fuel plants. It is also critical that we stabilize and segregate all public benefits money to ensure that the full cost-savings and innovative technology investments are maintained no matter what other financial pressures our state is facing.

To those ends, WISPIRG would make the following recommendations to the Task Force:

Support a Strong 10% by 2013 Target

- **Wisconsin should follow its priorities for the addition of new sources of energy by investing in renewable energy and energy efficiency projects before approving new fossil fuel plants**. Given that 7740 MW of new coal and gas have either been approved or proposed in the last few years and only 418 MW of wind, even with a 10% RPS, Wisconsin has a long ways to go to diversify its fuel mix.

- **Renewable energy should be generated in Wisconsin whenever possible**. Without promoting new in-state generation, it is conceivable that Wisconsin could miss out on the opportunities to create new jobs, generate income for local communities, and become a leader in this high tech industry despite adopting a 10% renewable energy target. If utilities are allowed to meet new renewable generation goals through projects anywhere in their system, it is estimated that they would choose to generate over 80% of all new wind energy at out-of-state wind farms.[i] It would be ironic if neighboring states such as Iowa and Minnesota, and even the providence of Manitoba, were the economic beneficiaries of Wisconsin's commitment to cleaner energy.

- **Wisconsin needs to adopt clear definitions about what will be counted as renewable energy and it is important that the state only except definitions**

that count emission-free, new generation, and environmentally sound projects. For this reason, the definition of acceptable hydroelectric power should remain as it is under our current Renewable Portfolio Standard that being no hydroelectric projects over 60 MW and total generation counted is capped at .6% are counted towards the RPS. While there are some efforts to allow all hydroelectric power to be counted under a new target, this would essentially undermine efforts to bring new generation of clean energy on line. In 2002, over 450 MW of hydropower was produced in Wisconsin and if all of this were to count towards a renewable energy goal, it would effectively wipe out 20% of new wind or other renewable energy from being generated.[ii] In addition, including hydroelectric power as preferable to wind, solar, and biomass is not beneficial as it has larger adverse environmental impacts because the dams reduce water level, alter water temperature, and hold back silt and debris which can bury fish spawning grounds.[iii]

- **Wisconsin should maximize continued new generation of clean and sustainable energy in our state by limiting utilities' ability to bank credits of energy that they have already produced to meet future obligations to three years**. Currently, Wisconsin is the only state in the nation that allows for indefinite banking of credits to allow utilities to meet their obligations under our RPS. As a result of this, Wisconsin utilities were able to meet their 2011 RPS goal by 2002, without having to bring any additional generation projects online.[iv]

- **Renewable energy currently being generated to meet other state's mandates should not be counted for any new Wisconsin target**. Not only does this undermine efforts to spur new developments in Wisconsin, more importantly, it creates the appearance of double-counting and undermines the spirit of generating new renewable energy period. Ensuring that the same energy was not being double counted to meet two state's mandates, would require a separate tracking and administrative process that will only add to the expense and the complexity of the a Wisconsin RPS.

- **Wisconsin should be aggressively working to generate renewable energy and should be getting 20% of our electricity from clean and sustainable sources of energy by 2020**. Given our state's abundant wind and biomass potential, coupled with the declining costs of renewable energy projects and our need to diversify our economy, Wisconsin should be looking beyond the next decade and planning to meet our growing energy needs with all around beneficial sources of energy rather than continuing to meet our needs with coal and natural gas.

- **Any discretion given to the Public Service Commission to excuse utilities from meeting defined goals should have clear guidelines**. Currently, it is proposed that a utility can apply for extension on the timeline for 'economic' or 'technological' infeasibility. However, those are very general terms and mere inconveniences or slightly higher costs should not be considered valid reasons for not meeting target timelines.

Protect the Public Benefits Fund

- **It is critical that the Public Benefits Fund be set up as a segregated account that can not be tapped by the Governor's office or the Legislature to be used as general funds.** The security of the Public Benefits Fund is critical not only to foster more beneficial energy efficiency projects, but also because unlike other funds, the misappropriation of these funds means that not only is the initial investment lost, but also all savings that could be obtained through the project. Independent audits of the Focus on Energy Program have found that for every dollar the state invested, there was a savings of five dollars.

- **Public Benefit Fund should be limited to helping as many residential and small businesses as possible.** The goal of the public benefits fund is to provide funds and expertise to small users who want to improve their energy efficiency but would not have the financial means to do upfront investments. It is not be used for a few large projects, such as the $1 million grant to General Motors Plant in Janesville.

- **Investment amounts in Public Benefits Fund should be set at the present day continuation of the 1995 levels trajectory.** Investments to the Publics Benefit Fund peaked in 1995 and then declined after changes in the program were made. Funding levels for the program should be set at the levels they would have grown to if the program was not altered.

Other Energy Improvements Wisconsin Could Make

- Wisconsin should adopt a mechanism for adopting the most efficient building codes as they come online.
- Wisconsin should commit to furnishing all new government buildings with Energy Star appliances.
- Wisconsin should adopt a model appliance efficiency bill which would require that a set percentage of appliances sold in the retail market be Energy Star appliances.

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[i] Thompson, Paul. A Study Evaluating the Impacts of Increasing Wisconsin's Renewable Portfolio Standard. University of Wisconsin-Madison. Fall 2003 Page 4

[ii] Wisconsin Energy Statistics 2003, Department of Administration.

[iii] *Ten Ways Dams Damage Rivers,* American Rivers

[iv] Thompson, Paul. A Study Evaluating the Impacts of Increasing Wisconsin's Renewable Portfolio Standard. University of Wisconsin-Madison. Page 7

Lee Cullen 6-16-3
Governor's Task Force on Energy Efficiency & Renewables

Re: Public Hearing, UWGB

Dear Task Force Members,

I'm a grunt in both the solar and home performance industries and have been for 25 years. I'm a consultant with the WECC administered WESH and HPES programs and do work with WECC and the MREA on solar thermal systems, which I also design and install. I was a member of the Demand Side Demonstration Panel and advised the Energy Center of Wisconsin when it had a Public Caucus.

The parts of the Public Benefits Program I work with are doing well. WESH homes are now 8% of the market. A sociological truism is that when a change affects 10% of a market, it becomes visible to the masses. HPES not only saves energy, it saves lives and health. I've had to red tag and shut off appliances that produced life-threatening amounts of CO. I routinely solve moisture problems that cause mold and thus asthmas and allergies.

Make no mistake, it is a very large undertaking to change the way a culture builds. There is vast momentum behind current practices, but they've become dysfunctional. Building science and home performance contracting is the way to fix the problems, and slowly the market is becoming aware of that. But it is a glacially paced process. Focus on Energy brings the best North American trainers here. We get ace information. Its quality solves problems and has created a break away industry in the state that does not exist in most other places. This was obvious at a recent national convention, Affordable Comfort. Badger people generally knew as much as the presenters, were the presenters, or knew more than they did. In a post-modern world, information leads the way.

It is easy and relatively inexpensive to reduce energy use by 10%. I often find four people using over 1,200 kWh/month when 600 kWh does similar households. Replacing a 1980 fridge with an Energy-Star efficient one earns 7-8% on the investment, tax free. A two panel solar water heater cuts total energy use by 8-12%/yr. and, with current rewards, has no effect on cash flow. It saves as much in energy as it adds to the cost of the mortgage. Avoided bills pay more than the cost of improvements, and the saved cash stays in Wisconsin communities as well as the money paid to contractors to install them. It is economic development by import substitution, and its potential is huge. What's 10% of $10 billion x two, the local economic multiplier?

Energy use in new homes—and all builders build energy efficient homes, just ask them—is around 5 Btu/sf-DD. With an extra 3% of materials and labor—and WESH standards—it can be half that or less. We know how to build net zero fossil energy homes using off the shelf materials and practices. It is expensive until you realize you are buying all your energy up front in bulk and at a fixed price. Amory Lovins, the all hip mahatma of the sustainable energy business, learnedly estimates that 40% of current use is fat that could economically be replaced by efficiency and renewables.

The Rocky Mountain Institute's *Small Is Profitable*, *The Economist* magazine's book of the year, documents how to do this and make money, more money with much less risk. Wisconsin can't get to these benefits under present IOU operating rules. As long as IOUs are rewarded only for being gencos and linecos, they will use 19^{th} Century, big-iron solutions to Wisconsin's energy problems. A way, and CA & OR have models, must be found to convert them to escos, energy service companies, to create more escos in the state by creating market structures that favor them. A huge step would be to begin taxing carbon. A small, but necessary step is to start time of use metering. Let price information drive the change. It is a legitimate market function Wisconsin is not taking advantage of.

IOUs are using demand at peak to stampede the herd into allowing them to build out base load coal gen. We have 9,300 MW of baseload (coal, nuke, hydro) gen capacity now, *Wis Energy Statistics 2002*. We use an average of 4,600 MW in winter; 6,300 MW is summer. There is plenty of base load reserve capacity, 32%. IOUs are not building base load plants to deal with a few hundred peak demand hours out of the year's 8,760. The problem is demand at peak, not a shortage of baseload capacity, though it grows, and peak can be shrunk, something other places have done, e.g. Southern California Edison, 8%/yr., year after year. But it takes persistence. Programs can't, as Wisconsin's have in the past, start, be stopped on a political whim, and expect to be effective. Stay the course.

Think of IOUs as giant economic pumps that remove cash from our communities, for 90% of the money we pay them is spent to buy fuels we don't have in Wisconsin. The bigger they get; the poorer we get. We must find ways to keep them healthy at the same time we reduce demand for fossil generated juice and shape the load to reduce peaks, e.g. GoodWatts technology, one of many automated demand response systems. IOUs could charge a small fee for reducing use and sell the saved electrons to another customer without the expense-risk-destruction of the proposed build out of coal gen plants.

Reducing demand and decentralizing generation are the path to reliability, too. Central plants and more miles of T&D lines are the way to an unstable system. A large-plant failure is more troublesome that a smaller one's, and T&D is the dominant source of power failures. With digitally dependent business, breaks in service are intolerably expensive, costly to Wisconsin's economy.

If the Saudi's have oil and the Dakotas have wind, Wisconsin has biomass. We can replace hydrocarbons with carbohydrates, e.g. biodiesel. Developing biomass to generate electricity in 20 MW plants scattered through the state, necessary to keep materials transportation costs low, would put a floor under the North Wood's and many agricultural economies as well as increasing system reliability. Enabling structures such as the Danes have for financing and managing community coop wind farms have to be crafted.

We also have large generating capacity in private hands such as Georgia Pacific in Green Bay. Being able to tap that capacity at peak demand times can be made very attractive with time of use rates and smart meters. Generating capacity freed by investments in efficiency such as Orion Energy Services often does in MW batches when it relamps a place such as Quad Graphics, ought be paid for by IOUs at a rate negotiated between the improvement's cost and the costs of building far more expensive generating and T&D capacity by the servicing IOU. I understand this can be done with a simple order by the PSC. Why hasn't this been done?

When California consumers realized how deeply they were being screwed by their IOUs, they bought efficiency that reduced demand by over 10% in one year. The potential loss of 10% of their market, now being subjected to a boiling-the-frog pace of rate increases, has to be sobering to Wisconsin IOUs, for if CA did it WI can, too. However, it was possible in CA only because its efficiency and RE market structure was well established. People were guided in their purchases to buying smart, to buying without rip off risk, to buying in an information rich market. Focus on Energy programs enable that in Wisconsin and offer some balancing force to the economically dominant IOUs. However, with their build out of coal gen—it increases base load by a third—and T&D, IOUs enter risky territory, a $7 billion bet over 20± years. Some of the hazards:

- A nimble gang of new technologies backed by corporations with enough muscle to shape the market is dancing just off the stage of mass awareness, as ready as hybrid cars to leave old ways behind
- The threat of carbon taxes promoted by a fair-haired politician who sees them as a way out of the property and income tax dead end, or are required by a world on the cusp of global warming disasters
- The threat of the mass market getting pissed off, behaving like California's, and buying increasingly attractive efficiency and RE
- The uncertainty of the whole political economy as its fossil carbon subsidy can't keep up with demand

Wild eyed optimists give us perhaps 20 years of having more supplies of oil and NG than demand. Pessimists say it will happen 2006-2010. Realists say it has already happened. IOUs risk a death spiral of ever increasing prices needed to service massive debt loads not supported by ever increasing demand for more energy as the wheels come off our economic truck. Think how rapidly that might happen if the Saudi street blows.

In the 1970s Wisconsin IOUs were in full panic cry. They had to have three more nuke plants, or we'd freeze in the dark. Environmental groups such as Northern Thunder defeated them, and saved them financially as events proved. If war is too important to be left to the generals; energy is too important to be left to IOUs.

Under Republicat corporate crony 'management' Wisconsin has gone from the cheapest to the most expensive energy in the Midwest. We need more than increased representation of whole house interactive issues in the *One & Two Family Code* and corrective tweaks to Focus commercial programs. Wisconsin needs a thorough overhaul of the regulatory structures that govern its energy market. Until that is done, we can't get on the 21st Century's soft path to sustainability, can't begin to have competitive rates.

Others, e.g. the EU, are well down the soft path. We continue down the hard path, but must get off. Enabling efficiency is the first step in the right direction. Building a Wisconsin-specific RE industry is the second step. As the Basques say, "We build the road as we travel." And, the good news is we can make money by doing the right thing.

Sincerely,

William Hurrle

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TASK FORCE on ENERGY EFFICIENCY & RENEWABLES

Something needs to be done to encourage townships & counties to pass ordinances that are friendly to renewable energy. Presently, Iowa County has a zoning ordinance for people under 40 acres that requires in excess of $250.00 fees & rezoning from agriculture to ag residential to install wind generators. I think the rezoning then means a higher property tax. Also state statues need to be strengthened to further encourage renewables.

Now on the "non taxable" customer charge. If the state insists on this 3% tax, they should at least make it progressive. The way it's set up those who use the most kw hours pay the least. It should be the other way around. My suggestion is that anyone who uses less than 250 kw hours per month should be exempt from the 3% tax & anybody over that pays 3% on the total.

Thank you for the opportunity to share my ideas.

Gary Jansen